ROLE OF TRANSVAGINAL SONOGRAPHY AND SALINE CONTRAST SONOGRAPHY IN THE EVALUATION OF ABNORMAL UTERINE BLEEDING AND ITS CORRELATION WITH HISTOPATHOLOGY

COIMBATORE MEDICAL COLLEGE, COIMBATORE.

Dissertation submitted in

Partial fulfillment of the regulations required for the award of

M.S. DEGREE (BRANCH II)

OBSTETRICS AND GYNAECOLOGY

THE TAMILNADU

DR. M.G.R. MEDICAL UNIVERSITY

CHENNAI

APRIL 2016

DECLARATION

I hereby declare that the dissertation entitled " **Role of trans vaginal sonography and saline contrast sonography in the evaluation of Abnormal uterine bleeding and its correlation with histopathology**" is a bonafide research work done by me at Coimbatore Medical College Hospital during the period from July 2014 to July 2015 under the guidance and supervision of **Dr. D. VATHSALA DEVI M.D.,D.G.O**., Professor, Department of **Obstetrics and Gynaecology**, Coimbatore Medical College.

This dissertation is submitted to The Tamilnadu Dr.MGR Medical University, towards the partial fulfilment of the requirement for the award of M.S., Degree (Branch II) in Obstetrics and Gynaecology. I have not submitted this dissertation on any previous occasion to any University for the award of any Degree.

Place: Coimbatore

Date: Dr. BIRUNDHA.V.J.

CERTIFICATE

This is to certify that the dissertation entitled "**ROLE OF TRANS VAGINAL SONOGRAPHY AND SALINE CONTRAST SONOGRAPHY IN THE EVALUATION OF ABNORMAL UTERINE BLEEDING AND ITS CORRELATION WITH HISTOPATHOLOGY**" is a record of bonafide work done by **Dr. BIRUNDHA V.J.** under the guidance and supervision of **Dr.D.VATHSALA DEVI, M.D.,D.G.O.,** Professor, Department of Obstetrics & Gynaecology, Coimbatore Medical College and submitted in partial fulfilment of the requirements for the award of M.S. Degree (Branch II) in Obstetrics & Gynaecology by The Tamilnadu Dr. MGR Medical University, Chennai.

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ACKNOWLEDGEMENT

To begin with, I thank the Almighty in making this project a successful one.

I express my deep gratitude to **Dr. Edwin Joe M.D.,B.L.,** Dean, Coimbatore Medical College, for permitting me to undertake this study.

I express my sincere gratitude to **Dr.P.Sundari, M.D.,D.G.O.,** Professor and Head, Department of Obstetrics & Gynaecology, Coimbatore Medical College, for having suggested this topic for dissertation and for having rendered her valuable support and encouragement without which this project work would not have been feasible.

I am extremely grateful to **Dr.D.Vathsala devi, M.D.,D.G.O,** my guide for her invaluable suggestions, constant encouragement and support in doing this endurable work.

I also wish to record my sincere thanks to all Associate and Assistant Professors of Department of Obstetrics & Gynaecology, Coimbatore Medical College, for their constant support and encouragement throughout the work.

I thank all the technical staffs in the Department of Obstetrics & Gynaecology, Coimbatore Medical College, for their sincere and timely technical assistance.

I express my heartfelt thanks to the Department of Radiology and the Department of Pathology, Coimbatore Medical College, for their constant support throughout the course of this study.

I express my heartfelt thanks and gratitude to my family for their extreme patience, constant support, encouraging words and source of strength all the way through this endeavour.

I will be failing in my duty if I do not make a special mention about the tolerance and cooperation extended by my **Patients,** during the course of my study. I sincerely thank them, for, without them this study would not have been possible.

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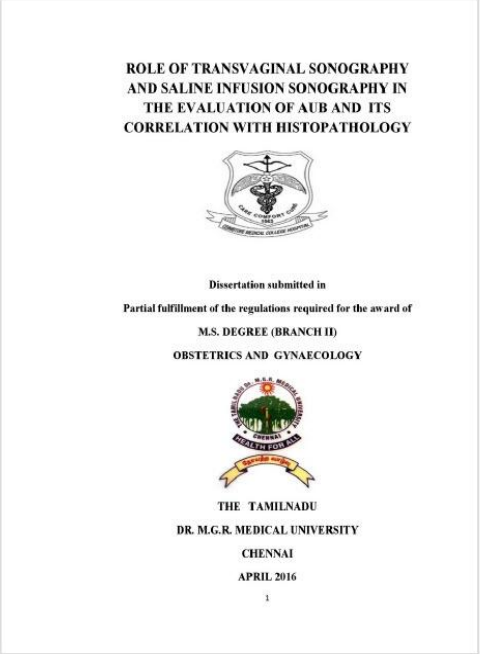
File name:	E_EVALUATION_OF_AUB_AND_IT...
File size:	894.12K
Page count:	81
Word count:	8,142
Character count:	45,621
Submission date:	14-Sep-2015 07:58PM
Submission ID:	566249550



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ABBREVIATIONS

ABBREVATIONS

TVS	:	Transvaginal ultrasonography
TAS	:	Transabdominal ultrasonography
SIS	:	Saline infusion sonohysterography
USG	:	Ultrasonography
DUB	:	Dysfunctional uterine bleeding
AUB	:	Abnormal uterine bleeding
D&C	:	Dilatation and curettage
PG	:	Prostaglandins
IUCD	:	Intrauterine contraceptive device
PCOD	:	Polycystic ovarian disease
ACOG	:	American College of Obstetrics and Gynaecology
FIGO	:	International Federation of Gynecology and Obstetrics
No.	:	Number
Vs	:	Versus
mm	:	Mili meter
ml	:	Mili liter
cm	:	Centimeter
mHz	:	Mili Hertz
S.m myoma	:	Submucous myoma
I.m myoma	:	Intramural myoma
End.hyperplasia	:	Endometrial hyperplasia

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INTRODUCTION

INTRODUCTION

Abnormal Uterine Bleeding (AUB) is a very common presenting illness among women attending Gynaecology OPD[1], diagnosis of which is often difficult as the cause may be widely variable from simple DUB to endometrial carcinoma. It accounts for about 15% of office visits and almost 25% of gynecological surgeries[2]. Hysteroscopy with directed biopsy has now become the reference standard investigation for AUB. This is because of its accuracy in diagnosing the endometrial abnormalities and the feasibility of treatment in the same sitting. However it is not used as a primary diagnostic procedure in patients with AUB[3]. This is because of its invasive nature and high cost.

Transvaginal sonography (TVS) has an important role in the initial evaluation of AUB as it is highly applicable and non invasive[4]. However its ability for screening the lesions in the endometrial cavity and focal endometrial lesions is limited. This can be overcome by Saline Infusion Sonography (SIS). It can be performed easily and rapidly and is well tolerated by the patients. It can accurately differentiate focal endometrial lesions and provides information about the localization and the extent of subendometrial lesions affecting the uterine cavity[5].

The infusion of saline serves as a contrast medium and distends the endometrial canal. This allows exquisite display of the inner lining of endometrium during real time imaging. This procedure is known by many names such as sonohysterography, ultrasonohysterography and saline infusion sonography.[6]

Today saline infusion sonography has evolved as a useful, safe and minimally invasive examination for women who have abnormal uterine bleeding, infertility and congenital uterine anomalies[6].

AIM AND OBJECTIVES

AIMS AND OBJECTIVES

To evaluate the diagnostic effectiveness of transvaginal sonography and saline infusion sonography in women presenting with abnormal utetrine bleeding and comparing them with histopathology as the gold standard diagnostic method.

REVIEW OF LITERATURE

REVIEW OF LITERATURE

S.Alborzi et al[7] made a study on comparison of the accuracy of Transvaginal sonography with Saline Infusion Sonohysterography for the screening of the causes of AUB. The conclusion is that SIS is better than TVS.

Statistical value	SIS	TVS
Sensitivity	94.1%	72%
Specificity	95%	92%
Positive predictive value	96%	94%
Negative predictive value	90%	64%

Reddi Rani P, Lakshmikantha G[8] from Jawaharlal Institute of Postgraduate Medical Education (JIPMER) have done a study on Transvaginal Sonography and Saline Infusion Sonohysterography in the evaluation of AUB. The conclusion is that SIS has better sensitivity and specificity than TVS. This is tabulated below.

Statistical value	SIS	TVS
Sensitivity	82%	65.5%
Specificity	95%	88%
Positive predivtive value	81%	68%
Negative predictive value	93%	90%

Mohammad Ali Karimzadeh M.D et al[9] did a study on diagnostic value of saline contrast sonohysterography comparing with hysteroscopy for detecting endometrial abnormalities in women with AUB. The results are tabulated.

Lesion	Sensitivity	Specificity
Polyp	73.3%	96%
Hyperplasia	71.4%	82.3%
Submucous myoma	90.9%	90.7%

Sensitivity and specificity for detecting submucous myoma is higher for sonohysterography than hysteroscopy. However it is not so in case of endometrial polyp and endometrial hyperplasia.

Suna Soguktas et al[10] did a study to compare the diagnostic efficacy of TVS, SIS and diagnostic hysteroscopy(HS). They took histopathology as gold standard. The most common abnormality detected was polyp. Comparing the three procedures with each other separately, the diagnostic accuracy was best with HS. HS and SIS were superior to TVS with (p_1 = 0.000, p_2 = 0.000). They have commented that TVS should be a first line investigative modality in the evaluation of AUB, though its role in the differential diagnosis of intracavitary abnormalities is limited. SIS and HS are alternative diagnostic procedures. In the detection of intracavitary abnormal pathologies they are more effective[11]

In this study they have compared Area Under the Curve (AUC) values which is a better method of statistical analyses of the diagnostic performances. AUC is a measure of the overall efficacy of a diagnostic test. It is interpreted as the average value of sensitivity for all possible values of specificity[12,13]. The conclusion is that HS provides the most accurate diagnosis and there is a provision for treatment in the same session.

Kelekci et al[14] did a study regarding the detection of endometrial polyp with saline infusion sonogram. They got a sensitivity of 70%, whereas the specificity, positive predictive value and negative predictive value were 100 %, 100 % and 90.9 % retrospectively. However in the detection of submucous myoma all of these parameters were 100 %.

Yildizhan B et al[15] has said that Saline infusion sono hysterography is an acceptable method of identifying endometrial lesions. It is a less invasive alternative to hysteroscopy.

Muhammad Aslam, et al[16] conducted a study comparing TVS and SIS and correlated them with hysteroscopy and histopathology.

Procedure	SIS	TVS
Sensitivity(%)	92.9	71.4
Specificity(%)	89.7	67.7

They say that SIS is a better investigation than TVS for the evaluation of endometrial intracavitary lesions. It can be decided whether hysteroscopy is needed or not based on the findings of SIS.

Salvatore Dessole M.D. et al[17] have performed a study to evaluate the risks and usefulness of sonohysterography in patients with endometrial carcinoma. Depth of myometrial invasion was evaluated using SIS. After hysterectomy the specimen was sectioned, the depth of gross myometrial invasion was visually estimated by surgical oncologist. Total number of cases taken was 32.

Procedure	SIS	Gross examination
No. detected correctly	27	25
% detected correctly	84.37	78.12

They concluded that SIS is a simple and safe procedure. However in high risk patients it should be carried out with caution.

Chiou Li Ong, MD, MBBS, FRCR[18] did a study on Saline infusion sonohysterography and termed it as a useful adjunct to TVS for the evaluation of endometrial cavity. SIS had a sensitivity of 98 % to 100 % whereas that for TVS was 75 % to 92 %.

Prachi Renjhen MD, S.Kanagasabai FRCOG[19] studied the role of sonohysterography in the evaluation of AUB.

Procedure	Sensitivity	Specificity
TVS	83 %	70.6 %
SIS	95 %	88 %
Hysteroscopy	100 %	100 %

Thus it is evident that saline sonohysterography improves the diagnostic accuracy.

Frank K Willem Jansen MD, PhD et al[20], made a study of Diagnostic hysteroscopy and saline infusion sonography in the prediction of intra uterine polyps and myomas. The positive predictive values of SIS and diagnostic hysteroscopy in the evaluation of intrauterine polyps and fibroids did not significantly differ. However, $p = 0.3$ is the significant difference for the positive predictive value of SIS in pre menopausal women comparing the positive predictive value of SIS for fibroids (0.95), and for polyps (0.81). Their study concluded that diagnostic hysteroscopy and SIS are equivalent diagnostic tools for the detection of intrauterine myomas and polyps.

ABNORMAL UTERINE BLEEDING

ACOG defines AUB[21] as bleeding from the uterine corpus that is abnormal in regularity, volume, frequency or duration and occurs in the absence of pregnancy. It may be acute or chronic.

Incidence of Abnormal Uterine Bleedding[23]

Reproductive age group – 10 to 30 %

Perimenopausal age group – 50 %

ETIOLOGY OF ABNORMAL UTERINE BLEEDING

Etiology of AUB varies according to the age group of the patient.

I. REPRODUCTIVE AGE GROUP

a) Pregnancy related complications

- Ectopic pregnancy
- Abortion
- Gestational trophoblastic disease
- Placenta praevia

b) Anovulation

- Polycystic ovarian disease
- Thyroid disease

c) Uterine pathologies

- Fibroids
- Endometrial polyps
- Endometriosis
- Pelvic Inflammatory Disease

d) Contraceptives

- Intrauterine contraceptive device
- Combined oral contraceptives

e) Hormone producing tumours of ovary

- granulosa cell tumours
- theca cell tumour

f) Malignant condition

- Endometrial Carcinoma
- Carcinoma cervix

- Carcinoma vulva
- Carcinoma vagina

g) Systemic diseases

- Hepatic diseases
- Renal diseases
- Adrenal dysfunction / tumour
- Coagulopathy
- Thrombocytopenia

II. PERIMOPAUSAL AGE GROUP

a) Anovulation 15%

b) Uterine lesions

- Fibroids 18 to 20%
- Polyps
- Adenomyosis
- Endometrial hyperplasia 1-7%
- Endometrial Carcinoma 3 to 5 %

c) Hormones producing tumour of ovaries

- Granulosa cell tumour
- Sertoli leydig cell tumour
- Gynandroblastoma of feminising type

III. POST MENOPAUSAL AGE GROUP

a) Benign conditions

- Senile vaginitis
- Atrophic endometritis
- Endometrial polyps
- Cervical polyps
- Vulval dystrophies
- Trauma
- Hormone replacement therapy

b) Feminising & hormone producing tumours of ovary

- Granulosa cell tumor
- Theca cell tumour
- Gynandroblastoma of feminising type

NEW FIGO CLASSIFICATION OF ABNORMAL UTERINE BLEEDING (AUB)

Terminologies used to describe abnormal uterine bleeding were:

Menorrhagia

Menorrhagia is defined as regular cycle with prolonged or heavy bleeding. The determining value is a blood loss of more than 80 ml.

Polymenorrhoea

It is defined as frequent cycles where the cycle length is decreased to an arbitrary limit of < 21days but normal bleeding .

Polymenorrhagia

Cycles are not only shortened to less than 21 days, but bleeding is prolonged and /or excessive.

Metrorrhagia

Metrorrhagia is inter menstrual acyclical bleeding of varying amounts but not excessive.

Menometrorrhagia

When the bleeding is so irregular and excessive that the menses cannot be identified at all the term applied is menometrorrhagia.

These confusing terminologies are discarded by FIGO in 2009 and replaced with the new simple descriptive terminologies. The new PALM COEIN system was published by FIGO in 2009 and is accepted by ACOG in 2012.

Accepted Terminologies by FIGO and ACOG:

Following are the terminologies accepted by FIGO and ACOG.

AUB - Abnormal uterine bleeding

HMB - Heavy menstrual bleeding

HPMB - Heavy and prolonged menstrual bleeding

IMB - Intermenstrual bleeding

PMB - Postmenopausal bleeding .

Acute AUB

Acute AUB[21] is defined as an episode of bleeding in a woman of reproductive age, who is not pregnant, of sufficient quantity to require immediate intervention to prevent further blood loss.

Chronic AUB

Chronic AUB[21] is defined as bleeding from the uterine corpus that is abnormal in duration, volume, and/or frequency and has been present for the majority of the last 6 months.

New FIGO Classification of Abnormal Uterine Bleeding[22]

Polyp
Adenomyosis
Leiomyoma
Malignancy & hyperplasia

Submucosal
Other

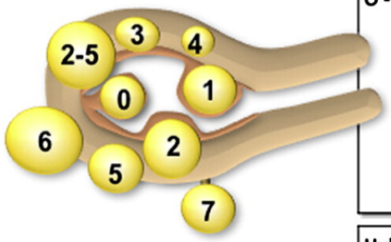
Coagulopathy
Ovulatory dysfunction
Endometrial
Iatrogenic
Not yet classified

Polyp
Adenomyosis
Leiomyoma
Malignancy & hyperplasia

Submucosal
Other

Coagulopathy
Ovulatory dysfunction
Endometrial
Iatrogenic
Not yet classified

Leiomyoma subclassification system



SM - Submucosal	0	Pedunculated intracavitary
	1	<50% intramural
	2	≥50% intramural
O - Other	3	Contacts endometrium; 100% intramural
	4	Intramural
	5	Subserosal ≥50% intramural
	6	Subserosal <50% intramural
	7	Subserosal pedunculated
	8	Other (specify e.g. cervical, parasitic)

Hybrid leiomyomas (impact both endometrium and serosa)	Two numbers are listed separated by a hyphen. By convention, the first refers to the relationship with the endometrium while the second refers to the relationship to the serosa. One example is below	
	2-5	Submucosal and subserosal, each with less than half the diameter in the endometrial and peritoneal cavities, respectively.

PALM – COEIN CLASSIFICATION[22]

According to this new classification there are 9 basic categories arranged in the order of PALM – COEIN.

PALM denotes the organic or the structural causes of AUB, whereas COEIN signifies the functional causes of AUB.

PALM – COEIN is abbreviated as

P – Polyp

A – Adenomyosis

L – Leiomyoma

M – Malignancy or Hyperplasia

C – Coagulopathy

O – Ovulation

E – Endometrial

I – Iatrogenic

N – Not otherwise classified

Polyps (AUB - P) :

Polyp is categorized and defined by ultrasonography, saline infusion sonography, hysteroscopy with or without histopathology. Polyps are common tumours in the uterus. They are usually benign. Polyps are small pink or red tumours projecting from the surface of the endometrium. A polyp is composed of endometrial stroma and glands covered by a single layer of columnar epithelium. Endometrial polyps are commonest in the body of the uterus. They are mostly multiple, sometimes as a part of a hyperplastic endometrium, but after the menopause they are single or few in number[25] .

Aadenomyosis (AUB – A):

Adenomyosis is defined as the presence of endometrial tissue in myometrium atleast 1 high power field (2.5 cm) from the basal layer of endometrium. Endometrial glands and stroma must be present. It may be diffuse adenomyosis or localized adenomyosis (adenomyoma). It can be diagnosed by ultrasound examination and Magnetic resonance imaging. However MRI is expensive and hence may not be available in many centres. In such cases ultrasound alone can be used for the diagnosis. Upon ultrasound examination, adenomyosis may present with heterogenous

myometrial echotexture, ill-defined anechoic areas of thickened myometrium consisting of blood filled, irregular cyctic spaces, or as an area of hyperechoeic myometrium with several cysts. This category of the PALM-COEIN may be further subdivided based on the depth of endometrial myometrial invasion[26].

Leiomyoma (AUB – L) :

According to the number, size and different locations, this group is further subclassified into primary, secondary and tertiary groups. The primary classification is based on the ultrasound findings i.e. either presence or absence of leiomyoma. Myomas that involve the uterine cavity are distinguished in secondary classification. It is essential because only these myomas cause AUB. Submucosal growths come under the tertiary classification.

Abnormal uterine bleeding may be associated with submucous, intramural and subserous fibroids, but there is a distinct clinical impression that bleeding is more common and severe in the presence of submucous myomas. The submucous myoma bleeds freely at menstruation and may also bleed in between periods as a result of necrosis, passive congestion, and ulceration of the endometrial surface over the tumour and ulceration of the contra lateral surface. If the submucous myoma is pedunculated, there is

usually a thin blood tinged discharge in addition to the menorrhagia. An intramural tumour that is just beginning to encroach on the uterine cavity can also be responsible for menorrhagia. There are several mechanisms by which leiomyoma can cause abnormal bleeding although a single specific mechanism may not be apparent in a particular patient. The surface area of endometrial cavity in a normal uterus is $15cm^2$. The surface area of the endometrial cavity in presence of leiomyomata may exceed $200cm^2$. There may be a correlation between the severity of bleeding and the area of endometrial surface. The endometirum may demonstrate local hyperestrogenism in areas immediately adjacent to submucous tumours in the form of endometrial hyperplasia and endometrial polyps. The presence of leiomyoma may interfere with myometrial contractility as well as contractility of the spiral arterioles in the basalis portion of the endometirum[27].

Malignancy and premalignant lesions (AUB) :

Malignancy is rare in the reproductive age group. It can occur in women with PCOS and chronic anovulation. Endometrial thickness can be measured by transvaginal sonogram and saline infusion sonogram. However the definitive diagnosis of endometrial carcinoma and endometrial hyperplasia can be done only by histopathological examination[26].

Coagulopathy (AUB – C):

Systemic disorders of hemostasis that cause AUB come under this group. This constitute for about 13-20% of women with AUB. The most common coagulopathy is von Willebrand's disease[26]. 90 % of them can be identified by a structured history[24].

Ovulatory disorders (AUB – O):

Anovulatory cycles contribute about 80% of people with AUB with irregular menstrual cycles and some with heavy bleeding. 20% are ovulatory but may be an outcome of Luteal – Out – of –phase (LOOP) events which are due to deficiency of progesterone[24]. Endocrinopathies causing AUB also come under this group.

Endometrial causes (AUB – E) :

Abnormal secretion of prostaglandins leads to dysregulation of the mechanisms of local endometrial hemostasis[24]. Also in our country it is not uncommon to find tubercular endometritis and other infections causing AUB.

Iatrogenic (AUB – I) :

These include the steroidal hormones, anticoagulants, phenothiazines and tricyclic antidepressants which affect dopamine metabolism. Contraceptive pills, IUCD come under this group.

Not classified (AUB – N):

Rare causes like arteriovenous malformations, varicose veins of the uterine vessels, myohyperplasia come under this group. In others no specific cause could be found out with the available investigations.

EVALUATION OF A PATIENT WITH AUB

In some women with AUB there may be no cause identifiable. In some others there may be multiple factors identified to be responsible for AUB28. Evaluation should begin with a proper history taking, thorough physical examination and appropriate investigations.

History should begin with age of the patient since the cause of AUB varies according to the age of the patient. Menstrual history should be properly elicited. Regularity, frequency, duration of bleeding and volume of blood loss should be correctly noted. History of postcoital bleeding should be enquired about. History of dysmenorrhoea and dyspareunia should also be asked for. History of recent abortion, delivery and ectopic pregnancy should be noted. Use of oral contraceptives, intrauterine contraceptive devices, hormone therapy and drugs taken should also be taken into account.

Symptoms related to thyroid disorder or any symptom of bleeding disorder should be considered while performing the investigations.

Examination should begin from a general physical examination, thyroid and breast examination. BMI should be calculated. Proper

speculum examination and a thorough pelvic examination should be carried out. Fornices should be examined for adnexal mass, tenderness and induration.

Investigations performed are

Laboratory tests:

1. Hb, TC/DC – to know the degree of anaemia,
2. BT, CT, Platelet count – to exclude coagulation disorders and leukaemia,
3. T 3 , T 4 & TSH - to know thyroid disorders
4. Fasting blood sugar - to know the state of diabetes

Imaging techniques:

Transabdominal sonography,

Transvaginal sonography,

Saline infusion sonography

Direct visualization of endometrial cavity by hysteroscope

Endometrial sampling:

Various sampling methods are available namely Novak's curette, Vibra aspirator, Karman canula with syringe, pipelle curette, dilatation and curettage and hysteroscopy directed biopsy.

Magnetic resonance imaging – only in rare situations to confirm Adenomyosis,etc,

Angiography and Venography – only in case where uterine A-V malformations are suspected.

ULTRASONOGRAPHY

Though so many noninvasive modalities have been developed to image the female pelvis, ultrasonography still continues to be the most accepted modality in imaging uterus and adnexa.

Physics Of Ultrasound

The basic principle of the high frequencies and directional beams required in medical ultrasound is the reverse Piezo electric effect. The Piezo electric effect was first discovered in 1880 by Pierre Curie. The ultrasound is generated by Piezo electric crystals like quartz or a synthetic ceramic material. It is the generation of electric voltage when a crystal is compressed or stretched. The reverse piezo effect is the voltage induced compression or expansion of crystal. An ultrasonic beam is a series of longitudinal waves which transmit energy. The longitudinal wave is propagated by multiple particles (molecules oscillating back and forth to produce bands of compression and rarefaction in the conducting medium). When these bands are scattered back to the piezo electric crystal, they change the crystal's thickness which produces an electric signal. This signal forms the basis of A-mode (Amplitude Modulation) displays and one dimensional static image showing echoes as spikes projecting from a baseline.

M - mode (Motion Displays) records the echoes as dots.

B - mode (Brightness Modulation) is a two dimensional display of the image produced, by moving a transducer either longitudinally or in cross section.

In Grey Scale imaging the echoes are displayed in various shades of grey depending on whether it is weak or strong. Weak echoes are displayed as light grey and strong ones are displayed as dark grey or black. The grey scale allows visualization of the fine internal consistency of soft tissue and the recognition of abnormal patterns characteristic of diffuse pathology.

Real time imaging:

To study the dynamic action of moving structures the real time imaging is used. It detects and displays motion as it occurs. A frame rate of 15 seconds or greater is adequate.

Two scanning techniques provide real time imaging.

They are:

Mechanical real time scanners (sector)

Multi element transducer assay (Linear array)

TRANSVAGINAL SONOGRAPHY :

High - resolution Transvaginal Sonography (TVS) is being widely used since the mid-1980s. It has gained acceptance as an integral part of gynecologic and early obstetric sonographic examinations[13].

Development of Trans Vaginal Sonography

The first stage of evolution was the so called A-mode technique. It used vertical deflections on a cathode ray to display the results. This first stage of TVS is connected with the name of 'Kratchowil'. In 1969, Kratchowil reported a new method of vaginal ultrasound imaging the so called compound technique.

Advantages of Transvaginal sonography:

1. Direct access to the pelvis - the transvaginal approach bypasses attenuating tissue and allows a high frequency probe to be placed close to the "target organs".
2. Empty Bladder technique - discomfort of full bladder associated with abdominal ultrasound is avoided.
3. Maximal information:
    a. In obesity

b. With adhesions

4. In depth of the pelvis Dynamic examination methodology

5. Detailed imaging of internal structures.

Disadvantages:

1. It has got a limited field of view,

2. Cannot be performed on virginal patients and who do not willingly consent to vaginal examination[28].

PERFORMANCE OF EXAMINATION

For transvaginal sonography an empty bladder is preferred. Scanning is performed with the patient in supine position with knees flexed. Buttocks may be elevated by using pillows. Partial lithotomy position can also be employed.

Probe preparation

The probe should be covered with a condom containing a small amount of coupling gel. Once the transducer has been covered, additional gel placed outside the sheath.

Examination technique

The probe is inserted into the vagina, the scan is performed through the anterior vaginal wall, anterior formix, lateral fornices and the cul-de-sac. The orientation of the probe is controlled by probe rotation and angulation.

Three basic scanning maneuvers are performed to achieve appropriate orientation:[18]

The probe can be rotated from 0 to 90 degrees about its long axis to obtain any plane of scan from sagittal to coronal.

The probe can be angled or pointed in any direction (within the limitations of vaginal discomfort) to direct the plane of section

The probe can be advanced or withdrawn, which will move adjacent pelvic viscera and displace bowel, and allow structures to be placed in the focal zone of the transducer.

Difference between transvaginal (TVS) and transabdominal ultrasound(TAS) (sautter)

Features	**TVS**	**TAS**
Penetration (cm)	8	13-18
Ultrasound frequency (MH_z)	5-10	3-5
Image quality	Better	-
Resolution	Higher	-
Nature of study	Dynamic	Static
Condition of study	Empty bladder	Full bladder
Visibility of pelvis	Blind spots Present	Blind spots absent
Organ representation	More accurate	-
Organ Assignment	Better	-
Internal structure	In detail	-
Diagnostic benefit in pelvis	Greater	-
Diagnostic benefit outside the pelvis	Not available	Excellent
Acceptance	Lesser	Higher

Transvaginal sonography appearance of endometrial changes in normal cycle:

Phases of cycle	**Endometrial morphology in TVS**
Early proliferative phase (day 4 -7)	Linear, homogenous echo. Endometrial thickness is 4mm
Mid-proliferative phase (day 8 – 10)	Endometrium gets thicker, echo-poor zones appear on both sides of a linear echo rich median stripe. Endometrial thickness is 6mm
Late Proliferative phase (day 11 – 14)	Loop shaped endometrial structure. Endometrial thickness is 8mm
Ovulatory phase	Annular structure appears. Endometrial thickness is 10mm
Mid secretory phase	Dense echo, reflection rich again piled up higher. Endometrial thickness is 12mm.
Late secretory phase	Endometrial structure disappears Endometrial thickness is 13mm.
Pre menstrual (day 26 – 28)	Echo-poor margin appears. Echo free zone in the uterine cavity appears Endometrial thickness is 14mm
Menstruation	Unrecognized endometrial echo in the diffuse reflections.

Various uterine pathologies in Sonography and HPE[30]:

Findings	Sonographic Criteria	Histologic Criteria
Polyp	Hyperechoic regular mass in the uterine cavity	Cystically dilated glands with thick walled vessels in a fibrous stroma
Hyperplasia	Regular endometrial thickness more than 12mm	Endometrial glandular twists with cellular secretory activity without cytonuclear abnormalities
Myomata	Hyper or hypoechoic rounded, well defined myometrial structures	Smooth muscle tumour
Atrophy	Endometrial thickness <4mm	Disappearance of the endometrial glands
Cancer	Irregularly thickened endometrium of variable echogenic texture	Cytologic nuclear abnormalities with structural disorders.

Saline Infusion Sonohysterography (SIS)

Saline infusion sonography is otherwise called saline contrast sonography or saline infusion sonohysterography. It is a technique where a catheter is placed into the uterine cavity through the cervical os. Sterile saline of about 10 to 20 ml is injected into the endometrial canal. The saline distends the cavity. Abnormalities such as endometrial polyps and intracavitary fibroids can be easily delineated. It has proved to be as reliable as visual inspection in describing intracavitary abnormalities.[31]

Saline Infusion Sonohysterography (SIS) is an innovative technique in evaluating a variety of endometrial and myometrial lesions, which involve the endometrial canal. The most common indication for SIS are AUB in both pre and post menopausal women.

Other indications include:[18]

1. Infertility
2. Recurrent pregnancy loss
3. Congenital anomalies of uterine cavity
4. Suspected adhesions of the uterine cavity

5. Screening before In Vitro Fertilisation

6. Post menopausal bleeding.

Benign endometrial polyps appear well-defined. They are uniformly homogeneous or hyperechoic. With Saline infusion sonography, the endometrial thickness can be measured separately from the polyp[32]. Polyps appear as protrusions into the cavity when examined at their stalks, otherwise they appear as balls of endometrial tissue surrounded by saline. It is important to note the number of polyps, their size, site, margin and areas of increased echogenicity. Colour Doppler can show the vascularity of pedicles and can demonstrate atypical blood flow pattern. This might suggest malignancy, though it is not specific or sensitive enough to rely in diagnosing malignancy.[22]

With conventional TVS, it is difficult to locate fibroids exactly. This is because they transmit sound poorly. They attenuate the sound beam and have ill-defined borders. Fibroids may obscure endometrial measurements when only TVS is used as they create an irregular interface between the myometrium and endometirum. Fibroids may vary in appearance. They may have calcified, hypoechoic, echogenic or isoechoic and mixed echogenic patterns. Degenerating fibroids often

appear cystic. SIS helps in classifying fibroids early and accurately by location, size and degree of intramural extension. They can be evaluated for hysteroscopic resectability. This is a major advantage because the ability to resect intracavitary fibroids completely will affect both clinical outcome and surgical complications.

Following is the classification of intracavitary uterine fibroids on the basis of SIS for the purpose of planning surgery.

Class 1 fibroids - Intracavitary and do not involve the myometrium. The base or stalk is visible with SIS.

1. Class 2 fibroids – They have a submucosal component which involves less than 50% of the myometrium.
2. Class 3 fibroids – They have an intramural component greater than 50% . It may be transmural and located anywhere from the submucosa to serosa. They often appear as a bulge or indentation into submucosa when viewed hysteroscopically.

Class 1 or 2 fibroids can be resected successfully using hysteroscope by an experienced and skilled surgeon. Class 3 fibroids are less amenable to hysteroscopic surgery because of a significant probability of perforation, fluid overload, contracture of the endometrial cavity and incomplete resection[29].

The endometrial thickness of each wall can be measured separately. This helps in identifying focal thickening which could be specifically biopsied at hysteroscopy. The surface of the endometrium should be examined for irregularities.

Heterogeneity of the endometrium, irregularity of the junction between the myometrium and endometrium, poor distention of the uterine cavity on injecting saline and uniform increased echogenicity of the endometrium should raise the suspicion of malignancy.[18]

Endometrial cancer can be suspected when the endometrium is irregular, has mixed echogenicity, has irregular borders, demonstrates endomyometrial interface disruption[23].

Most studies report that the endometrium is thicker in patients subsequently found to have malignant endometrial pathology than in patients with benign conditions. An

endometrial echo of less than 4 mm will be rarely associated with endometrial cancer. In most of the endometrial cancers, the thickness is greater than 4.7mm.

Scheduling the Saline Infusion Sonohysterography[33]:

The patient should be examined when there is the best chance of making the most specific / sensitive diagnosis. Ideally SIS is scheduled when the endometrium is thinnest, most homogenous.

In premenopausal women, SIS is performed in the proliferative phase (first half) of menstrual cycle. If possible it is optimal to wait until the bleeding has stopped because blood clots can be confused for focal lesions.

In post menopausal women, if patient is on HRT, then SIS should be scheduled approximately 6 days after the last progestin pill when endometrium is thinnest. If HRT not taken, can be scheduled at any time.

Advantages of Saline Infusion Sonoography as compared with hysterosalphingography:

SIS offers several advantages over conventional HSG (hystero salphingography).

1. No ionising radiation.
2. Does not require an expensive fluroscopic/ radiographic dye which eliminates the small risk of anaphylactic reaction to these agents if there is intravasation.
3. SIS is less uncomfortable than HSG as in later there is quick distension of endometrial cavity after blocking the cervix which leads to painful cramping, but with SIS there is slow gradual distention and the extra fluid can leak out thus decreasing the incidence of painful cramping.
4. SIS allows for visualization of myometrium, external contour of uterus and adnexae.

Disadvantages of SIS:

1. Tubal anatomy is not visualised with SIS. Tubal patency can be inferred by demonstration of fluid appearing in the cul-de-sac after saline instillation, but it does not indicate which of the tubes in patent.
2. Risk of infection

3. Eventhough SIS correctly evaluates the depth of myometrial invasion, chances of spread of malignant cells into the peritoneum is present in case of endometrial carcinoma[33].

Diagnostic pitfalls:

Passage of Catheter:

Sometimes there may be difficulty in introducing the intrauterine catheter. This is more common in case of previous cervical surgeries. Initial passage of the sound usually resolves these difficulties.

Analgesia:

It is a simple procedure and does not require any analgesia except in some patients who might have colicky pain during or after the procedure. They can be given simple NSAID like tablet Diclofenac half an hour prior to the procedure.

Inadequate distension of cavity

In certain cases where there is a patulous cervix adequate quantity of fluid may not be retained to distend the cavity. In such cases it is better to use the bulb of the Foley's catheter instead of using other plastic catheters and intra uterine insemination catheters.

Contraindications to SIS :

Although SIS is in general a safe procedure with little discomfort, there are several contraindications to it:

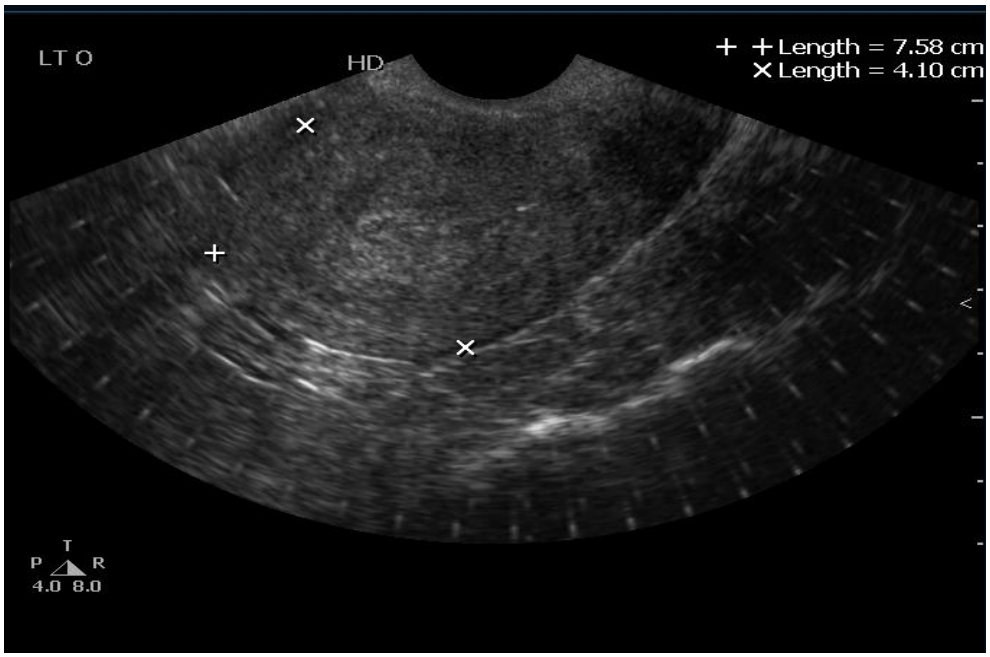
i. Possible pregnancy, to avoid the possibility of disrupting an implanting gestation.

ii. Infection or pelvic pain suggestive of pelvic infection to avoid exacerbating the symptoms.

iii. Intractable cervical stenosis, which would make insertion of a catheter difficult and uncomfortable.[28]

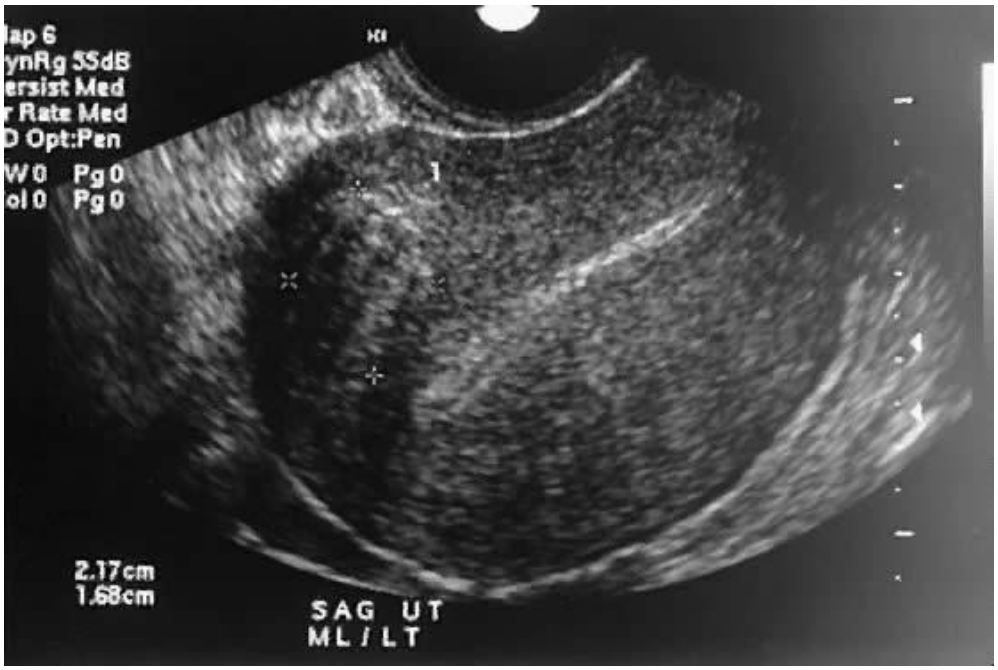
iv. Diagnosed cases of endometrial carcinoma.

Transvaginal Ultrasound – showing a normal endometrial cavity

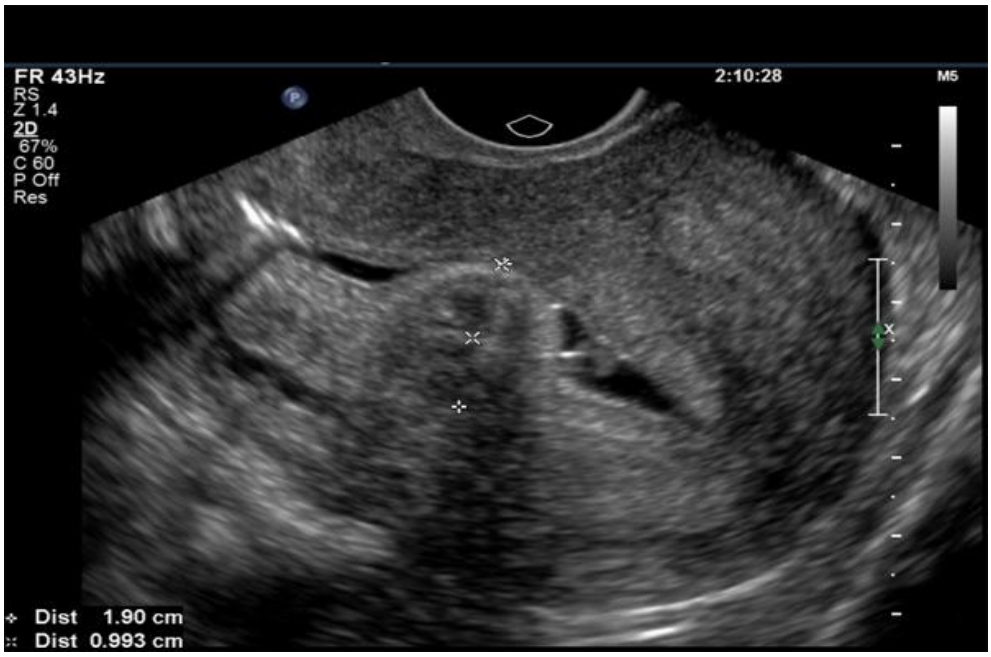


SIS on the same patient- showing normal uterine cavity

Trans vaginal sonography –showing intramural myoma



Saline infusion sonography – showing submucous myoma



METHODOLOGY

METHODOLOGY

This prospective study was conducted on 100 inpatients in the department of Obstetrics and Gynecology, Coimbatore Medical College Hospital, Coimbatore. The Ethics committee of the hospital has approved the study. Informed consent was obtained from all the patients.

The study included patients in reproductive age group with complaints of abnormal uterine bleeding, in the form of menorrhagia, metrorrhagia and polymenorrhoea who underwent hysterectomy.

A detailed history was taken, with special emphasis on menstrual history. Specific history was asked to rule out the systemic disorders responsible for abnormal uterine bleeding. Thorough clinical examination was carried out including breast, thyroid and pelvic examination. Relevant laboratory investigations were done. All the patients were then subjected to sequential evaluation with TVS and SIS before hysterectomy was done.

All TVS examinations were performed first using endovaginal probe of 7.5 MHz (covered by a condom). The patient was asked to empty the bladder before the procedure and then placed in dorsal position with knees flexed a little. TVS was used to examine both ovaries and the uterus. The uterus was scanned in the sagittal and coronal planes for the presence of myometrial masses, and the endometrium was examined for an endometrial pathology. The endometrial thickness was measured at the widest point between the endometrial – myometrial interfaces in the sagittal plane. The presence of focal endometrial thickening or a focal mass was noted.

The cervix was swabbed with the povidine-iodine solution. No.8 Foley's catheter was placed in the cervix and the balloon inflated with 1.5 to 2 ml of distilled water such that it lies just above the internal os. This blocks the distension fluid from flowing out from the endometrial cavity. Speculum was removed and the vaginal probe (covered by a condom) was reinserted.

Sterile saline was infused gently until the distension of the uterine cavity was adequate to see any lesion or till pain appears and the findings were noted. Saline acts as a contrast that fills the

uterine cavity. Uterine cavity was visualized in longitudinal plane from one ostia to the other and in coronal plane from fundus to endocervix.

The endometrial cavity was examined for the presence of polyps or submucosal myoma. Any projection inside the uterine cavity was observed with special attention to its shape and echnogenicity. Evidence of abnormal endometrial thickening was also noted. The balloon was deflated and the catheter gently removed.

The hysterectomy specimen was examined both grossly and histopathologically. Findings were compared with that of TVS and SIS.

SELECTION CRITERIA

(a) Inclusion Criteria

1.Women presenting with abnormal uterine bleeding such as menorrhagia, metrorrhagia, menometrorrhagia and polymenorrhea in the reproductive age group and perimenopausal age group, who were posted for hysterectomy, after failure of all the medical measures.

(b) Exclusion Criteria

1. Postmenopausal women,
2. Women with evidence of systemic disease
3. Evidence of pregnancy,
4. Evidence of PID
5. Previous H/O uterine surgery, cervical surgery,
6. Endometrial biopsy within the previous one year,
7. Puberty menorrhagia,
8. Unmarried women.

OBSERVATIONS AND RESULTS

OBSERVATIONS AND RESULTS

The study was conducted in Coimbatore medical college hospital from July 2014 to July 2015. In this study hundred patients who were being subjected to hysterectomy for AUB were analysed. It was made sure that they were fulfilling the inclusion and exclusion criteria. The women who had any evidence systemic diseases such as diabetes, hypertension, PCOS, thyroid disorder, evidence of endometriosis were not taken into the study.

In three cases there was difficulty in passing the cathter for saline infusion as the patients complained of pelvic discomfort. The procedure was stopped for some time. They were given analgesic injection and then the study was resumed. In five cases there was leakage of the injected saline. There the procedure was completed with difficulty.

Mean age of the patients taken in the study is 42.17 years (range 28 to 51). Mean duration of the symptoms is 8.8 months (range 1 to 36). The observations are tabulated in the following pages.

TABLE – 1 AGE WISE DISTRIBUTION

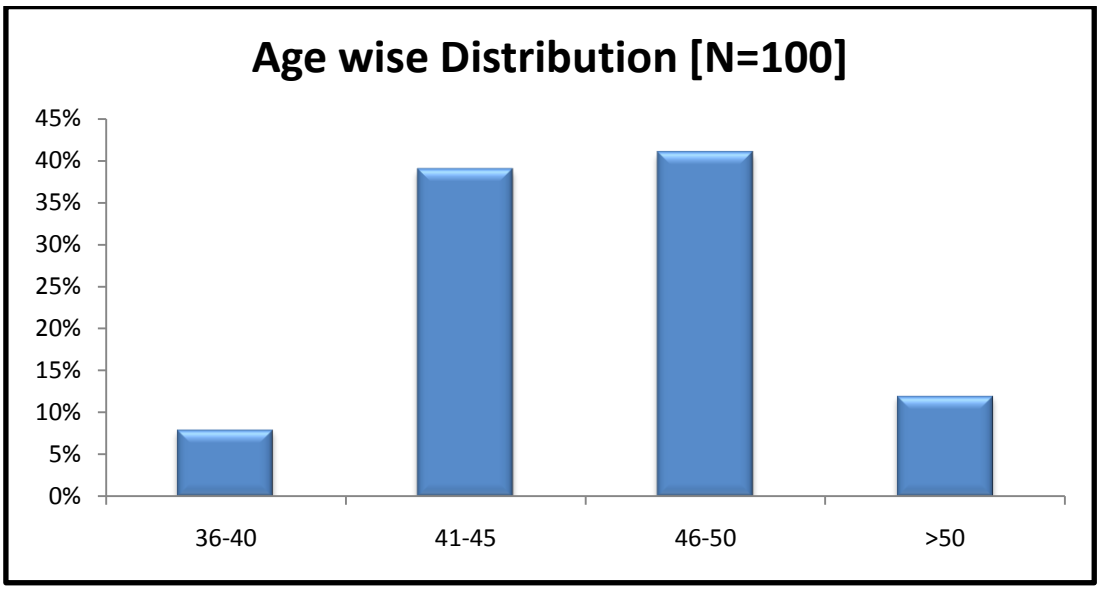
Age (years)	Frequency	Percent
36-40	8	8%
41-45	39	39%
46-50	41	41%
>50	12	12%
TOTAL	100	100%

According to this table all patients in the study group belong to the reproductive and perimenopausal age group.

AGE GROUP OF THE PATIENTS

Number	Minimum	Maximum	Mean
100	36	53	43.81

GRAPH - 1



Maximum number of patients are in the age group 41 – 45 and 46 – 50 years. 39% in the first and 41 % of patients are there in the second group.

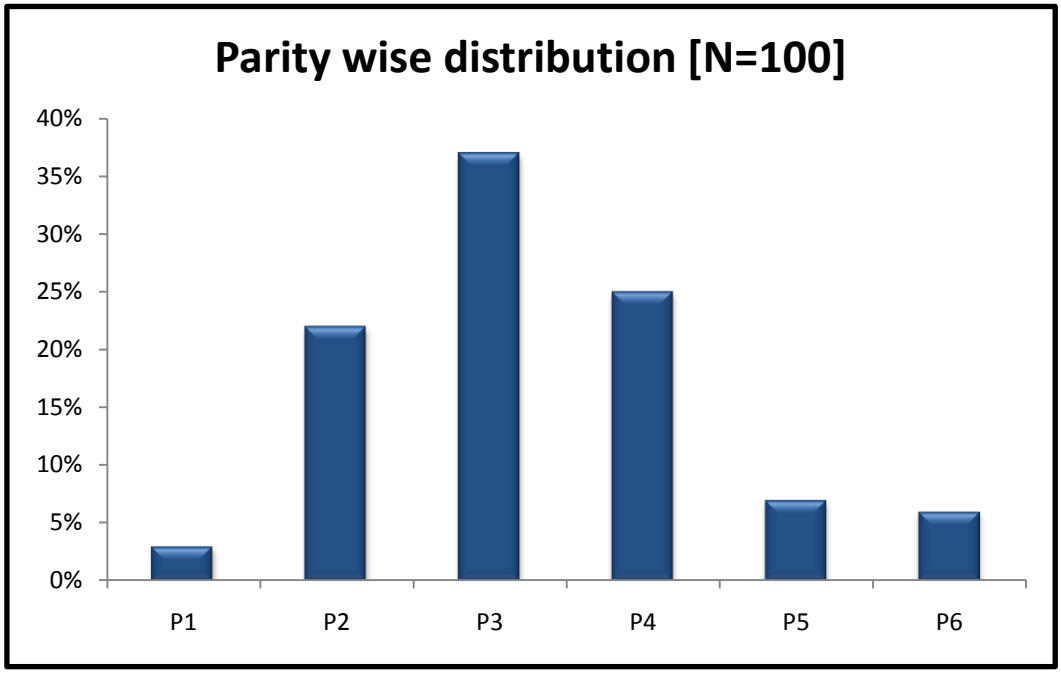
TABLE – 2

DISTRIBUTION ACCORDING TO PARITY

Parity	Frequency	Percent
P_1	3	3%
P_2	22	22%
P_3	37	37%
P_4	25	25%
P_5	7	7%
P_6	6	6%
Total	100	100%

37 % of the patients had delivered thrice. 25% patients had 4 children and 22% patients had 2 children.

GRAPH - 2



According to this graph greater incidence of AUB was noted in multiparas. Among the 100 women, none were nulliparous.

TABLE – 3

DISTRIBUTION OF PATIENTS ACCORDING TO DURATION OF SYMPTOMS

Duration(months)	Frequency	Percent
1-3	8	8%
4-6	37	37%
7-9	30	30%
10-12	15	15%
24	7	7%
36	3	3%
Total	100	100%

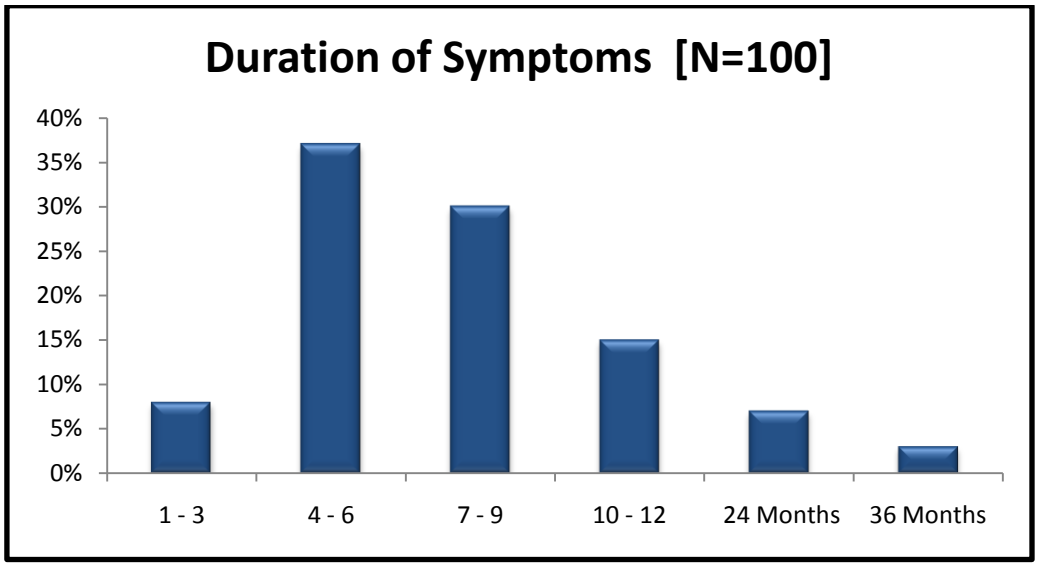
This table reveals that 37% of patients had symptoms for 4 to 6 months of duration and another 30 % had symptoms for 7 to 9 months.

DURATION OF SYMPTOMS (YEARS)

Number	Minimum	Maximum	Mean	Std.deviation
100	1	36	8.8	6.98

GRAPH – 3

DISTRIBUTION OF PATIENTS ACCORDING TO DURATION OF SYMPTOMS



In maximum number of patients duration of symptom was between 4-6 months with a range of 1 month to 3 years.

TABLE – 4

DISTRIBUTION ACCORDING TO DIAGNOSIS ON TVS

Findings	Frequency	Percent
Endometrial hyperplasia	24	24%
Intramural myoma	15	15%
Submucous myoma	17	17%
Endometrial polyp	6	6%
Normal	38	38%
Total	100	100%

In 24% of patients endometrial hyperplasia was noted. 15% had intramural myoma, 17% had submucous myoma and 6% had polyp.

GRAPH - 4

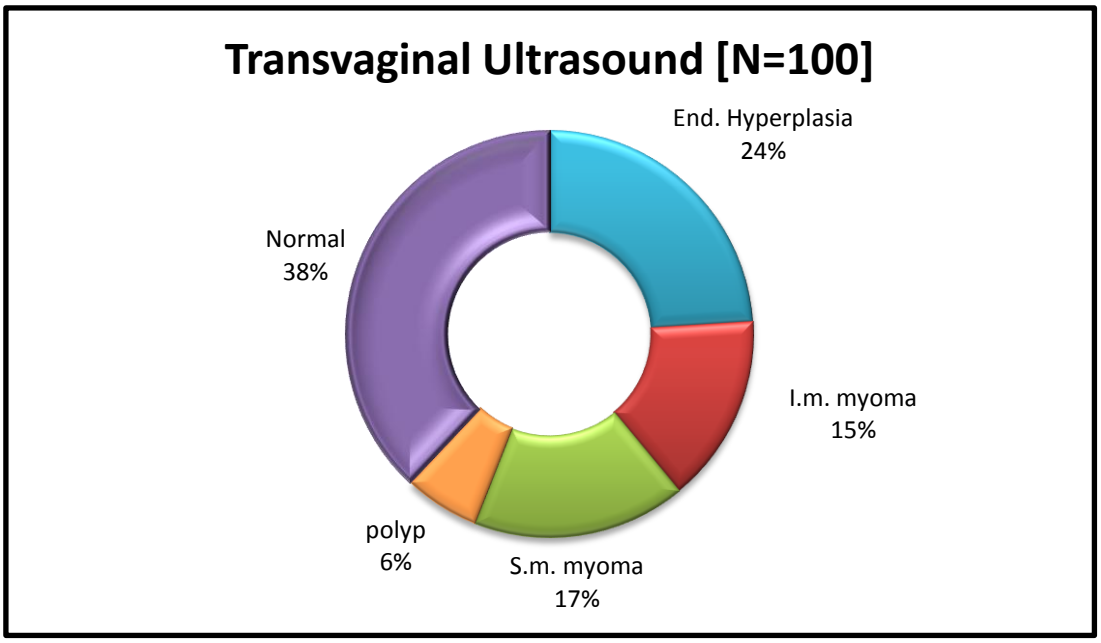


TABLE – 5

DISTRIBUTION ACCORDING TO DIAGNOSIS MADE ON SIS

Findings	Frequency	Percent
Endometrial hyperplasia	20	20 %
Intramural myoma	13	13 %
Submucous myoma	19	19 %
Endometrial polyp	8	8 %
Normal	40	40 %
Total	100	100%

SIS diagnosed 20 % of patients as having endometrial hyperplasia, 19% as submucous myoma and 13% as intrmural myoma.

GRAPH – 5

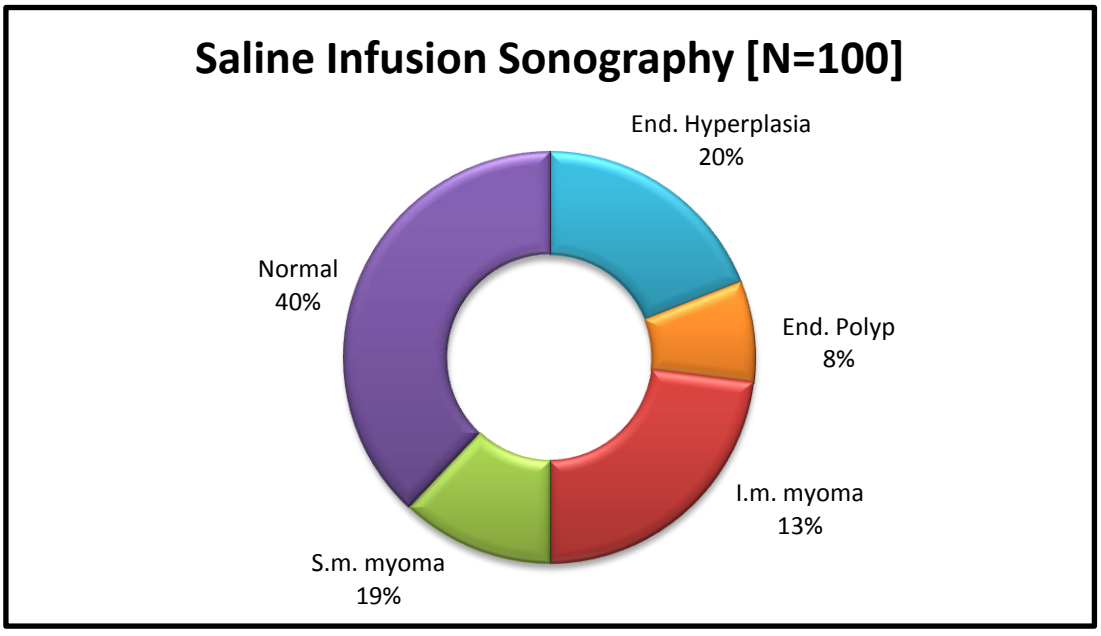


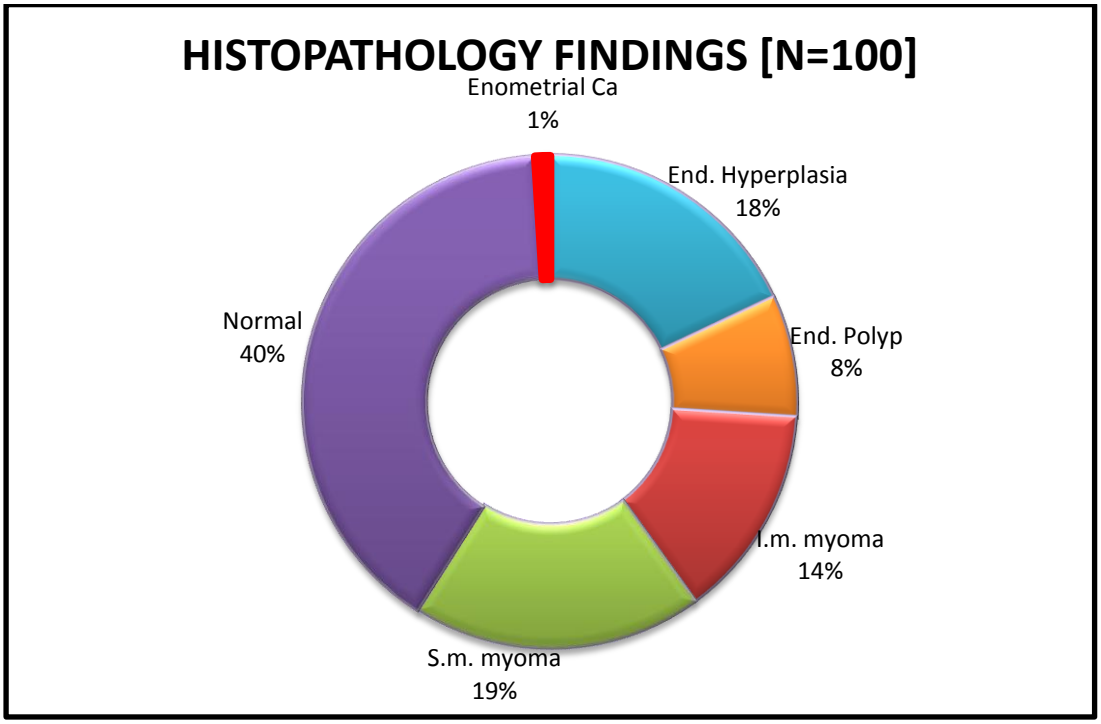
TABLE - 6

DISTRIBUTION ACCORDING TO THE DIAGNOSIS BASED ON THE HISTOPATHOLOGICAL EXAMINATION

Findings	Frequency	Percent
Endometrial hyperplasia	18	18 %
Intramural myoma	14	14 %
Submucous myoma	19	19 %
Endometrial polyp	8	8 %
Normal	40	40 %
Endometrial carcinoma	1	1 %
Total	100	100 %

Histopathological examination included both gross and microscopic examination of the uterine specimen after hysterectomy and it was considered the gold standard.

GRAPH - 6



Gross and microscopic examination of the hystrectomised specimen has shown endometrial hyperplasia in 18 % of cases, submucous myoma in 19% , intramural myoma in 14 % and endometrial polyp in 8 % of the cases. In 40 % of the cases it was a normal uterus.

TABLE - 7

COMPARISON OF THE DIAGNOSIS BY THE 3 INVESTIGATION MODALITIES

Diagnosis	TVS	SIS	HPE
Endometrial hyperplasia	24	20	18
Intramural myoma	15	13	14
Submucous myoma	17	19	19
Endometrial polyp	6	8	8
Normal	38	40	40
Endometrial carcinoma	0	0	1
Total	100	100	100

TVS findings did not correlate with that of the final diagnosis in 36 cases. The 18 false negative diagnosis included 3 endometrial hyperplasia, 5 submucous myoma, 4 intramural myoma, 3 endometrial polyps, 1 endometrial carcinoma and 2 cases of normal uterus. In 18 cases the results of TVS were false positive . They were 9 endometrial hyperplasia, 3 submucous myoma, 5 intramural myoma and 1 case of endometrial polyp.

SIS findings did not correlate with that of the final diagnosis in 16 cases. The 8 false negative were 2 endometrial hyperplasia, 2 submucous myoma, 2 intramural myoma ,1

endometrial polyp and 1 case was carcinoma of the endometrium . In 8 cases the results of SIS were false positive. They were 4 endometrial hyperplasia, 2 submucous myoma, 1 intramural myoma and 1 case of endometrial polyp.

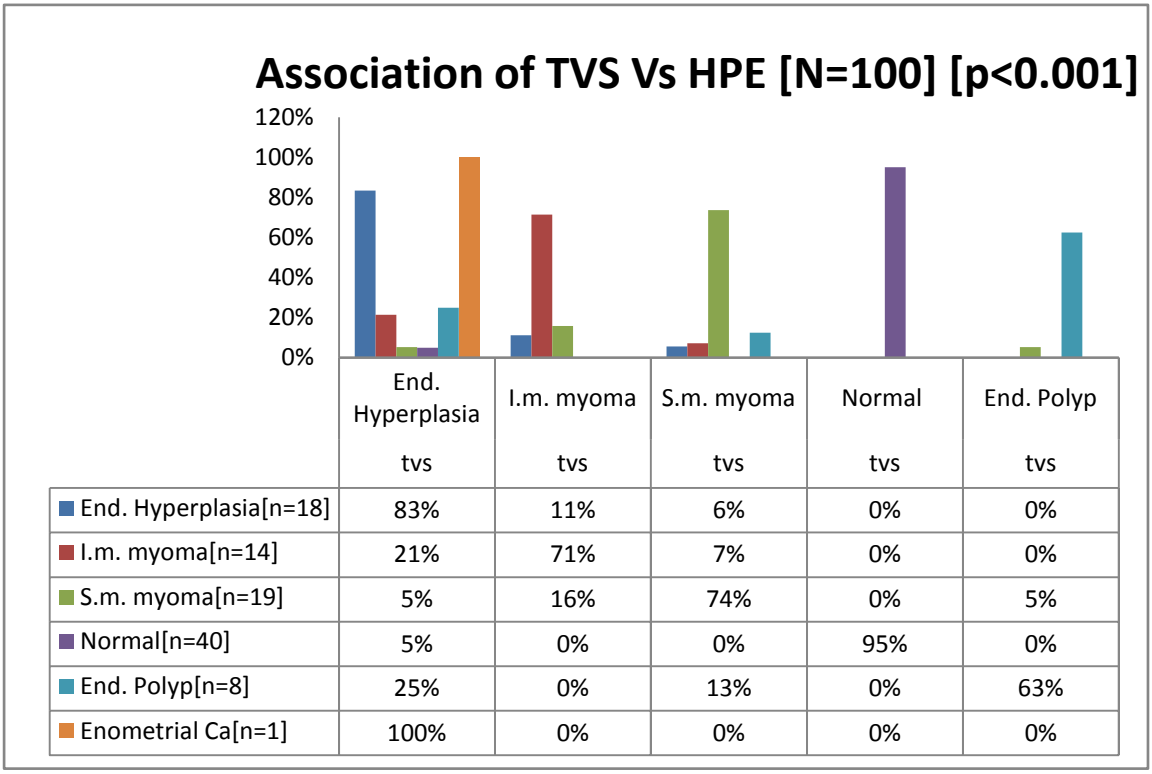
1 case of endometrial carcinoma was falsely diagnosed as endometrial hyperplasia by both the imaging modalities namely TVS and SIS.

The commonest HPE finding noted was submucous myoma followed by endometrial hyperplasia, whereas the commonest findings on TVS and SIS were endometrial hyperplasia followed by submucous myoma.

These variations in the diagnoses are depicted in the following two graphs.

GRAPH 7

ASSOCIATION OF DIAGNOSIS MADE BY TRANSVAGINAL SONOGRAPHY VS HISTOPATHOLOGY

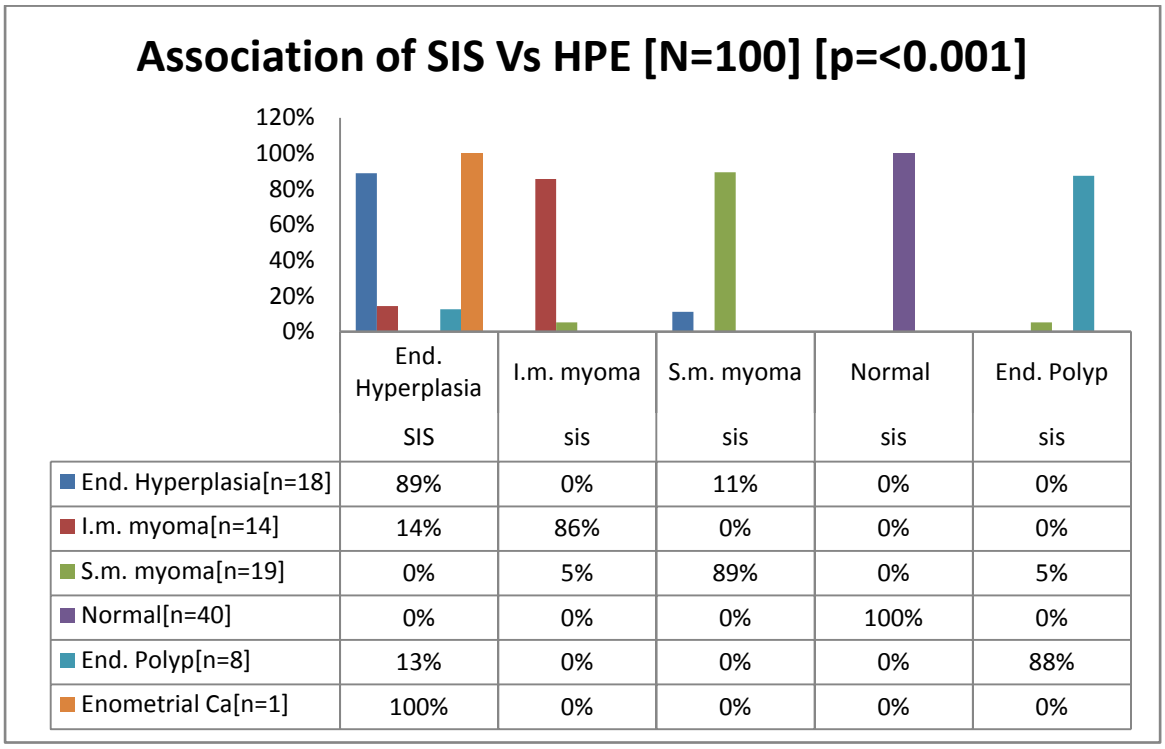


	End. Hyperplasia tvs	I.m. myoma tvs	S.m. myoma tvs	Normal tvs	End. Polyp tvs
End. Hyperplasia[n=18]	83%	11%	6%	0%	0%
I.m. myoma[n=14]	21%	71%	7%	0%	0%
S.m. myoma[n=19]	5%	16%	74%	0%	5%
Normal[n=40]	5%	0%	0%	95%	0%
End. Polyp[n=8]	25%	0%	13%	0%	63%
Enometrial Ca[n=1]	100%	0%	0%	0%	0%

The sensitivity of TVS is 83% for endometrial hyperplasia, 71% for intramural myoma, 74% for submucous myoma and 63% for endometrial polyp.

GRAPH - 8

ASSOCIATION OF DIAGNOSIS MADE BY SALINE INFUSION SONOGRAPHY VS HISTOPATHOLOGY



	End. Hyperplasia SIS	I.m. myoma sis	S.m. myoma sis	Normal sis	End. Polyp sis
End. Hyperplasia[n=18]	89%	0%	11%	0%	0%
I.m. myoma[n=14]	14%	86%	0%	0%	0%
S.m. myoma[n=19]	0%	5%	89%	0%	5%
Normal[n=40]	0%	0%	0%	100%	0%
End. Polyp[n=8]	13%	0%	0%	0%	88%
Enometrial Ca[n=1]	100%	0%	0%	0%	0%

The sensitivity of SIS is 89% for endometrial hyperplasia, 86% for intramural myoma, 89% for submucous myoma and 88% for endometrial polyp.

TABLE - 8

DIAGNOSTIC PERFORMANCES OF TVS AND SIS IN IDENTIFYING VARIOUS CAUSES OF AUB

Diagnosis / Test performance	Endometrial hyperplasia		Submucous myoma		Intramural myoma		Endometrial polyp	
	TVS	SIS	TVS	SIS	TVS	SIS	TVS	SIS
Senitivity %	83.33	88.89	73.68	89.47	71.43	85.71	62.5	87.5
Specificity %	89.02	95.12	96.30	97.53	94.19	98.84	98.91	98.92
Positive predictive value %	62.50	80.00	82.35	89.47	66.67	92.31	83.33	87.50
Negative predictive value %	96.05	97.50	93.98	97.53	95.29	97.70	96.81	98.20

From the above table it is evident that sensitivity, specificity, positive predictive value and negative predictive value were all greater for SIS compared to that for TVS.

TABLE - 9

OVERALL STATISTICAL PERFORMANCES OF TVS AND SIS

Statistical performance	TVS	SIS
Sensitivity %	72.74	87.89
Specificity %	94.61	97.60
Positive predictive value %	73.71	87.32
Negative predictive value %	95.53	97.73

Again it is proved that SIS has a higher sensitivity, specificity, positive and negative predictive value compared to TVS.

All the statistical analyses were performed using a statistical software package (SPSS Version 16 for windows). A p value of <0.05 using a two - tailed test was taken as being of significant for all statistical tests.

DISCUSSION

DISCUSSION

Abnormal uterine bleeding is an important and common problem suffered by woman of any age group not only from menarche to menopause, but also after menopause. Heavy menstrual bleeding is the abnormal bleeding that has an impact on the woman's quality of life. It may affect the woman physically and emotionally restraining her from daily activities, or socially being the reason for her absence in workplace. It may also affect the woman's material quality of life.

As mentioned earlier the causes of abnormal uterine bleeding vary depending on the age of the patient. Investigations should be chosen promptly keeping in mind the commonest causes. After the initial investigations to know the general condition of the patient, there comes the specific investigations to identify the exact pathology responsible for the abnormal bleeding. Imaging modalities play an important role here before the endometrial sampling methods.

Transvaginal ultrasonography is being perfomed as an initial investigation modality in the evaluation of uterine pathologies responsible for AUB. It can be performed easily in the outpatient setting itself. No premedication or anaesthesia is required. There is

no need for prior cervical dilatation. Since a sterile condom is always used to cover the transvaginal probe the chance of infections is very minimal or almost nil. The images can be saved for future references.

Saline infusion sonography is one step ahead of trans vaginal sonography where sterile saline infused through the cathter acts as a contrast medium inside the uterine cavity. The endometrial intracavitary pathologies which may be difficult to diagnose by TVS could easily be differentiated with the use of SIS.

Diagnostic hysteroscopy has become an acceptable modality of investigation to visualize the uterine cavity and perform biopsy in the same sitting if necessary. However this is an invasive procedure, costlier than sonography and requires a more complicated setup. In a developing country like India this is still not available to every patient.

Hence the present study was conducted to find out and compare the diagnostic effectiveness of TVS and SIS. Various studies have already been done in small scale and also in large scale comparing the two modalities.

DISTRIBUTION OF PATIENTS ACCORDING TO AGE

The mean age of the patients in this study was 43.81 years with a range of 36 to 53 years. Maximum number of patients are in the age group of 41 to 45 and 46 to 50 years. That is in the reproductive age and perimenopausal age group. In the study by Saidi et al [33] age group taken was 40 to 89 years. Mean age of patients in the study by Reddi Rani P and Lakshmikantha G[8] was 45.56 years and in that by Muhammad Aslam et al[16] was 38.3 ± 9.6 years (range 25 to 68 years). All other studies also had women of reproductive, perimenopausal and postmenopausal age group.

NUMBER OF PATIENTS IN DIFFERENT STUDY GROUPS

Authors	No of patients
Reddi Rani & Lakshmikantha	52
Muhammad Aslam et al	100
Saidi et al	68
Present study	100

The number of patients in different study groups varied. In the present study 100 patients were taken for analysis.

The duration of symptoms ranged from less than 6 months to upto 3 years. Maximum number of patients had complaints within 4 to 6 months. The mean duration was 8.8 months with a standard deviation of 6.98.

This study showed that SIS has higher sensitivity and specificity when compared with TVS. Similar findings were observed in the studies by Saidi et al [34], Reddi Rani P and Lakshmikantha G[8] and Muhammad Aslam et al[16].

In the present study sensitivity and specificity of TVS was 72.74 % and 94.61%. Sensitivity and specificity of SIS was 87.89 % and 97.6%. The positive predictive value and negative predictive value of TVS was 73.71 % and 95.53 %. The positive predictive value and negative predictive value of SIS was 87.32% and 97.73 %. All these were calculated taking into account histopathology as the final diagnosis. The association was calculated using chi square test and was statistically significant.

SUMMARY OF VARIOUS STUDIES

Study	Procedure	Sensitivity %	Specificity %
Saidi et al[34]	TVS	95.7	63.6
	SIS	90.9	83.3
Reddi Rani & Lakshmikantha[8]	TVS	65.5	88.0
	SIS	82.0	95.0
Muhammad Aslam et al[16]	TVS	71.43	67.7
	SIS	92.86	89.65
Present study	TVS	72.74	94.61
	SIS	87.89	97.60

de Kroon et al[35] in a meta analysis made review of sixteen different studies which comprised 877 procedures. The diagnostic accuracy was compared between SIS and hysteroscopy in the women presenting with AUB in the perimenopausal age group. The sensitivity of SIS was 95% in the evaluation of uterine cavity and it also showed an 88% of pooled specificity.

The sensitivity and specificity of SIS and TVS was different for the different lesions. Various studies have also confirmed this. The sensitivity and specificity for endometrial polyp was 70 % and 95.35% for TVS whereas it was 90% and 98.11% for SIS in the study by Muhammad Aslam et al. The sensitivity and

specificity for the same endometrial polyp was 71.4 % and 97% in the study by Rani Reddi and Lakhmikantha. Similar results were obtained in our study also.

With regard to submucous myoma, the sensitivity and specificity of TVS was 61.54 % and 97.67 % whereas that for SIS was 100 % both, in the study by Muhammad et al. 27.3 % , 85 % for TVS and 81.8 %, 97 % for SIS, the sensitivity and specificity respectively for submucous myoma in the study by Reddi Rani and Lakshmikantha. In our study they were 73.68 % and 96.30% for TVS and 89.47 % and 97.53% for SIS. Hence it is evident that SIS has a higher sensitivity and specificity for the intracavitary pathologies compared to TVS.

All imaging techniques can have a number of false results even in the experienced hands. It may be because of the large intra mural myomas compressing the cavity, hemorrhagic debris, sessile polyps, and polyps arising from endocervix. Sometimes even the bulb of the foley's catheter may compress the lesion. Ryu et al [36] noted false results in 12 % of the case. These were because of the small polyps which measured less than 5 mm, presence of uterine synechiae and chronic endometritis.

Three patients experienced pelvic discomfort while performing SIS in our study. In the study by Cicinelli et al[37] severe pain was experienced by 11 % of the patients. The pain may be due to difficulty in passing the catheter in stenosed cervix. The pain due to distension of the uterine cavity can be minimized if saline instillation is controlled and stopped as soon as the lesion is detected.

Rate of infection following the procedure could not be found out in our study because only the patients posted for hysterectomy were taken into the study. Hence long term follow up could not be done. However in a review by Chung et al[38] of 900 procedures of SIS, an infection rate of 0.6 % was observed. Infection rate of about 1% and pelvic pain of about 1 % was noted in the study by Bonnamy et al[39].

LIMITATIONS

LIMITATIONS

Only a small sample size was taken. Most of our patients belonged to the lower socio economic status. Hence these findings may or may not be generalizable. Inter observer variations are possible. Cases were selected only from patients posted for hysterectomy for AUB and not from the OPD. Hence the results may not be applicable to the general population .

SUMMARY

SUMMARY

The present study was carried out in 100 patients posted for hysterectomy for AUB in Coimbatore medical college hospital.

The patients were taken up for sequential examination with transvaginal sonography and saline infusion sonography after obtaining an informed consent.

1. In the present study, the age of the patient ranged from 36 to 53 years, with the maximum number belonging to age group 41 to 45 years and 46 to 50 years, 39 % in the first group and 41% in the second group.
2. Parity of the patients ranged from 1 to 6. Maximum number of patients were P3 (37 %).
3. The duration of the symptoms ranged from 1 month to upto 3 years. Maximum number of patients had complaints for 4 – 6 months (37%).
4. On transvaginal sonographic evaluation, endometrial hyperplasia was diagnosed in 24% cases, submucous myoma in 17%, intramural myoma in 15% and endometrial polyp in 6% cases. In 38% of the patients no specific abnormality was found.

5. On saline infusion sonographic evaluation, endometrial hyperplasia was diagnosed in 20% cases, submucous myoma in 19%, intramural myoma in 13% and endometrial polyp in 8% cases. In 40% of the patients no specific abnormality was found.
6. On gross and microscopic examination of the hystrectomised specimen, endometrial hyperplasia was diagnosed in 18% cases, submucous myoma in 19%, intramural myoma in 14% and endometrial polyp in 8% cases. In 40% of the patients no specific abnormality was found. Endometrial carcinoma was noted in 1% of the patients.
7. Endometrial carcinoma was not diagnosed by both TVS and SIS in our study.
8. The sensitivity of TVS was 72.74%, specificity was 94.61%, the positive predictive value was 73.71% and negative predictive value was 95.53%.
9. The sensitivity of SIS was 87.89%, specificity was 97.6%, the positive predictive value was 87.32% and negative predictive value was 97.73%.
10. The association between TVS and SIS was statistically significant [chi square test, p value <0.05].

11. No complications, particularly infection occurred with saline infusion sonography.
12. In 3 patients the procedure had to be stopped for some time as the patients experienced pelvic pain.

CONCLUSION

CONCLUSION

Transvaginal sonography and saline infusion sonography together is a very sensitive and specific technique for diagnosing any intrauterine abnormality in cases of AUB. Both are simple, minimally invasive and low cost technique. SIS outlines the uterine cavity. Myoma, polyp or endometrial abnormality missed on transvaginal ultrasound alone is identified accurately with this technique. Hence it can even help in choosing the case where hysteroscopy and directed biopsy is required. There are no significant complications associated with SIS. Therefore we recommend that SIS should be used as a first line investigation in the evaluation of AUB along with TVS.

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ANNEXURE I

PROFORMA

Serial no : Hospital no :

Name : D.O.A :

Age :

Address :

I. **CHEIF COMPLAINTS**

II. **HISTORY OF PRESENTING COMPLAINTS:**

III. **MENSTRUAL HISTORY:**

Age of menarche

Present menstrual cycle

Duration of cycle :

Amount of flow:

Duration of flow:

Associated dysmenorrhoea:

Previous menstrual cycles-

Duration of cycles:

Amount of flow:

Duration of flow:

Associated dysmenorrhoea:

Date of last menstrual period

:

iii) OBSTETRIC HISTORY:

Married life : no. of children :
Para: living: abortion:
Last child birth:

V) PAST HISTORY:

Tuberculosis/ bronchial asthma/ diabetes mellitus/ hypertension/ thyroid disorder / any surgeries

VI) FAMILY HISTORY:

Tuberculosis/ bronchial asthma/ diabetes mellitus/ hypertension/ any malignancy

VII) PERSONAL HISTORY:

Diet:

Appetite:

Bowel:

Micturation:

Sleep:

GENERAL PHYSICAL EXAMINATION:

Pallor, icterus, clubbing, edema,

lymphadenopathy, cyaonsis.

Blood Pressure: Height:

Pulse: Weight

BMI :

Breast:

Thyroid:

Spine:

Systemic examination

Cardio vascular system:

Respiratory system:

Abdominal examination:

- Inspection
- Palpation
- Auscultation

Per speculum examination:

Per vaginal examination:

INVESTIGATIONS

Blood group, Rh typing

Hb: PCV

TC: DC:

BT: CT:

Platelets:

FBS,

PPBS:

Urine routine:

Pap smear:

TVS and SIS findings:

- Uterine size
- Endometrial thickness
- Any fibroid/ polyp/ septa
- Adnexa

COMPARISON AND COMMENTS:

ANNEXURE II

MASTER CHART

S.NO	IP NO	NAME	AGE	PARITY	DURATION OF SYMPTOMS (MONTHS)	TRANSVAGINAL ULTRASOUND	SALINE INFUSION SONOGRAPHY	HISTO PATHOLOGY
1	49834	Ramathal	41	P2 L2	9	Normal	Normal	Normal
2	48271	Subbammal	38	P2L2	7	I.m. myoma	I.m. myoma	I.m. myoma
3	53823	Kalamani	46	P3L3	24	Normal	Normal	Normal
4	57829	Saraswathi	49	P4L4	5	End. Hyperplasia	Normal	Normal
5	58755	Baby	47	P4L4	4	End. Hyperplasia	End. Hyperplasia	End. Hyperplasia
6	52035	Shanthi	39	P2 L2	6	Normal	Normal	Normal
7	62912	Sumathi	43	P3L3	8	Normal	Normal	Normal
8	66617	Thamarai selvi	48	P4L4	4	End. Hyperplasia	End. Hyperplasia	End. Hyperplasia
9	60536	Nageshwari	28	P1L1	7	Normal	Normal	Normal
10	63654	Thangamani	50	P6L6	1	S.m. myoma	S.m. myoma	S.m. myoma
11	63616	Arulmozhi	41	P4L4	36	Normal	Normal	Normal
12	64469	Ponnammal	38	P3L3	7	Normal	Normal	Normal
13	68431	Savitha	48	P5L5	1	End. Hyperplasia	End. Hyperplasia	End. Hyperplasia
14	67493	Selvi	39	P2L2	4	End. Hyperplasia	End. Hyperplasia	I.m. myoma
15	68462	Vasugi	42	P4L4	8	Normal	Normal	Normal
16	68464	Saraswathi	33	P1L1	4	End. Hyperplasia	Normal	Normal
17	70181	Devi	38	P3L3	5	I.m. myoma	I.m. myoma	I.m. myoma
18	71732	Krishnaveni	40	P3L3	24	Normal	Normal	Normal
19	71738	Ramathal	49	P5L5	5	End. Hyperplasia	End. Hyperplasia	End. Hyperplasia
20	74386	Saroja	39	P2L2	6	End. Polyp	End. Polyp	S.m. myoma
21	72615	Maimoon	46	P4L4	11	Normal	Normal	Normal
22	72652	Meenakumari	40	P3L3	12	I.m. myoma	I.m. myoma	I.m. myoma
23	76868	Eswari	36	P2L2	11	Normal	Normal	Normal
24	76939	Vimala	43	P4L4	6	End. Hyperplasia	End. Hyperplasia	End. Hyperplasia
25	80161	Alagammal	51	P6L6	9	Normal	Normal	Normal
26	81981	Saraswathi	42	P2L2	9	S.m. myoma	S.m. myoma	S.m. myoma
27	80964	Velammal	40	P3L3	8	Normal	Normal	Normal
28	88372	Kamalaveni	39	P3L3	36	Normal	Normal	Normal
29	83299	Parameshwari	45	P4L4	5	I.m. myoma	I.m. myoma	I.m. myoma

30	68369	Saraswathi	38	P2L2	10	Normal	Normal	Normal
31	4014	Saral	41	P3L3	5	I.m. myoma	I.m. myoma	I.m. myoma
32	5285	Pappathi	48	P4L4	6	End. Hyperplasia	End. Hyperplasia	End. Hyperplasia
33	1003	Krishnaveni	38	P3L3	8	S.m. myoma	S.m. myoma	S.m. myoma
34	4140	Umarani	50	P6L6	9	Normal	Normal	Normal
35	7863	Thulasimani	49	P5L5	5	S.m. myoma	End. Hyperplasia	End. Hyperplasia
36	7677	Karuppathal	47	P4L4	6	S.m. myoma	End. Polyp	End. Polyp
37	5664	Kalpana	36	P2L2	4	End. Hyperplasia	End. Polyp	End. Polyp
38	10302	Rajeshwari	37	P3L3	8	Normal	Normal	Normal
39	8687	Rangammal	46	P4L4	7	I.m. myoma	I.m. myoma	I.m. myoma
40	13049	Sakunthala	50	P4L4	24	End. Hyperplasia	End. Hyperplasia	End. Hyperplasia
41	11280	Joice	42	P3L3	9	I.m. myoma	I.m. myoma	I.m. myoma
42	32031	Mallika	48	P6L6	6	End. Hyperplasia	End. Hyperplasia	End. Hyperplasia
43	13054	Sampoornam	40	P3L3	5	S.m. myoma	S.m. myoma	S.m. myoma
44	11281	Rajammal	38	P3L3	10	I.m. myoma	I.m. myoma	I.m. myoma
45	16670	Devika	29	P2L2	11	Normal	Normal	Normal
46	17507	Jyothi	45	P4L4	9	I.m. myoma	I.m. myoma	I.m. myoma
47	15661	Valarmathi	40	P3L3	2	S.m. myoma	S.m. myoma	S.m. myoma
48	18374	Doulath nisha	37	P2L2	10	Normal	Normal	Normal
49	18374	Banumathi	46	P4L4	8	I.m. myoma	I.m. myoma	I.m. myoma
50	19030	Kasiyammal	46	P3L3	6	Normal	Normal	Normal
51	20882	Vasantha	41	P3L3	5	End. Hyperplasia	End. Hyperplasia	End. Hyperplasia
52	18373	Selvi	44	P4L4	5	S.m. myoma	S.m. myoma	S.m. myoma
53	23949	Rajamani	36	P2L2	24	Normal	Normal	Normal
54	22456	Shanthi	40	P3L3	8	S.m. myoma	I.m. myoma	I.m. myoma
55	26415	Mahalakshmi	48	P5L5	4	End. Hyperplasia	End. Hyperplasia	End. Hyperplasia
56	27995	Baby	47	P4L4	7	End. Polyp	End. Polyp	End. Polyp
57	23998	Usha devi	46	P3L3	8	Normal	Normal	Normal
58	28010	Anitha	37	P2L2	4	S.m. myoma	S.m. myoma	S.m. myoma
59	30456	Selvi	32	P3L3	10	Normal	Normal	Normal
60	28162	Nagalakshmi	39	P2L2	13	End. Hyperplasia	End. Hyperplasia	End. Polyp
61	32112	Kamalam	49	P4L4	6	End. Polyp	End. Polyp	End. Polyp
62	31259	Mahalakshmi	43	P3L3	10	S.m. myoma	S.m. myoma	S.m. myoma
63	32829	Aysha	47	P3L3	24	Normal	Normal	Normal
64	34387	Vahitha banu	51	P3L3	4	End. Hyperplasia	I.m. myoma	I.m. myoma
65	33510	Girija	45	P3L3	8	End. Hyperplasia	S.m. myoma	S.m. myoma

66	41003	Rajeshwari	47	P4L4	14	End. Hyperplasia	End. Hyperplasia	End. Hyperplasia
67	39218	Jothimani	28	P3L3	24	Normal	Normal	Normal
68	38373	Kasthuri	36	P2L2	3	S.m. myoma	S.m. myoma	S.m. myoma
69	37544	Priya	39	P3L3	11	Normal	Normal	Normal
70	949	Subbulakshmi	37	P2L2	5	I.m. myoma	S.m. myoma	S.m. myoma
71	5609	Amudha	46	P4L4	9	Normal	Normal	Normal
72	7900	Chandramani	48	P6L6	6	End. Hyperplasia	End. Hyperplasia	End. Hyperplasia
73	8687	Rangammal	44	P3L3	7	I.m. myoma	S.m. myoma	End. Hyperplasia
74	79321	Reshma	34	P2L2	10	Normal	Normal	Normal
75	1193	Saraswathi	46	P4L4	4	S.m. myoma	S.m. myoma	S.m. myoma
76	1963	Chandra	49	P4L4	6	End. Hyperplasia	End. Hyperplasia	End. Hyperplasia
77	1193	Suganthi	47	P3L3	5	End. Hyperplasia	End. Hyperplasia	I.m. myoma
78	9668	Thulasimani	38	P2L2	8	End. Polyp	End. Polyp	End. Polyp
79	9732	Kaliyammal	48	P5L5	10	Normal	Normal	Normal
80	10567	Mahadevi	50	P6L6	3	End. Hyperplasia	End. Hyperplasia	Enometrial Ca
81	49589	Vanaja	39	P3L3	5	S.m. myoma	S.m. myoma	S.m. myoma
82	7926	Rajeshwari	33	P1L1	9	Normal	Normal	Normal
83	15062	Vasanthi	36	P2L2	11	Normal	Normal	Normal
84	13371	Chitra	41	P3L3	3	End. Polyp	End. Polyp	End. Polyp
85	15903	Parimala	40	P3L3	7	S.m. myoma	S.m. myoma	S.m. myoma
86	15046	Yagoba	49	P5L5	6	End. Hyperplasia	End. Hyperplasia	End. Hyperplasia
87	14125	Tamil selvi	47	P4L4	9	Normal	Normal	Normal
88	17560	Mangayar thilagam	46	P3L3	5	S.m. myoma	S.m. myoma	S.m. myoma
89	18726	Sankarammal	43	P3L3	8	I.m. myoma	I.m. myoma	S.m. myoma
90	20135	Mala	29	P2L2	10	Normal	Normal	Normal
91	18746	Angammal	38	P2L2	2	End. Polyp	End. Polyp	End. Polyp
92	25184	Sundari	42	P3L3	12	Normal	Normal	Normal
93	28347	Suguna	37	P2L2	24	Normal	Normal	Normal
94	30654	Danalakshmi	44	P4L4	5	End. Hyperplasia	End. Hyperplasia	End. Hyperplasia
95	25832	Malarvizhi	40	P3L3	4	I.m. myoma	S.m. myoma	End. Hyperplasia
96	55871	Shanthi	51	P5L5	8	Normal	Normal	Normal
97	55359	Periyammal	48	P4L4	6	I.m. myoma	S.m. myoma	S.m. myoma
98	58371	Ayisha	38	P3L3	8	Normal	Normal	Normal
99	58422	Ramathal	46	P4L4	7	S.m. myoma	S.m. myoma	S.m. myoma
100	5943	Sabitha	39	P3L3	36	Normal	Normal	Normal

ANNEXURE III

ஒப்புதல் படிவம்

பெயர் .

வயது .

முகவரி .

அரசு கோவை மருத்துவக் கல்லூரியில் மகப்பேறு மற்றும் பெண்கள் மருத்தவ துறையில் பட்ட மேற்படிப்பு பயிலும் மாணவி **வை.ஜெ.பிருந்தா** அவர்கள் மேற்கொள்ளும் **"மாறுபட்ட கருப்பை உதிரப்போக்கின் காரணிகளைக் கண்டறிவதில் பிறப்புறுப்பின் வழியாக ஸ்கேன் மற்றும் கர்ப்பபையில் நீர் செலுத்தி ஸ்கேன் செய்வதின் பங்கினைக் கண்டறிந்து அவற்றை திசுப் பரிசோதனை முடிவுகளுடன் ஒப்பிடுதல்"** பற்றிய ஆய்வில் செய்முறை மற்றும் அனைத்து விளக்கங்களையும் கேட்டுக் கொண்டு எனது சந்தேகங்களை தெளிவுப்படுத்திக் கொண்டேன் என்பதை தெரிவித்துக் கொள்கிறேன்.

நான் இந்த ஆய்வில் முழு சம்மதத்துடனும், சுய சிந்தனையுடனும் கலந்து கொள்ள சம்மதிக்கிறேன்.

இந்த அய்வில் என்னைப் பற்றிய அனைத்து விவரங்கள் பாதுகாக்கப்படுவதுடன் இதன் முடிவுகள் ஆய்விதழில் வெளியிடப்படுவதில் ஆட்சேபனை இல்லை என்பதை தெரிவித்துக் கொள்கிறேன். எந்த நேரத்திலும் இந்த ஆய்வில் இருந்து நான் விலகிக் கொள்ள எனக்கு உரிமை உண்டு என்பதையும் அறிவேன்.

இடம்

தேதி கையொப்பம் , ரேகை

WRITTEN INFORMED CONSENT

I, _____ age ____ resident of _____ have been explained the details about the above mentioned study and hereby give my consent for participating in the study titled "**Role of Transvaginal Sonography and Saline Contrast Sonography in the Evaluation of AUB and its Correlation with Histopathology**". I am told that if accepted, this study may be published in scientific journals. I give my approval for the same provided no personal details of identifying features are mentioned.

Place: signature:

Date: Name: